Mississippi Valley Division,
Regional Planning and Environment Division South

St. Tammany Parish, Louisiana Feasibility Study

Appendix D – Annex 5 - Cost Engineering

June 2021

TABLE OF CONTENTS

1 COST

1.1 Cost Estimates for Final Array of Alternatives (Alternates 4, 5, 6, 7, 8, and 9)

1.1.1 Cost Estimate Development

The project cost estimate was developed in the MCACES MII cost estimating software and used the standard approaches for a feasibility estimate structure regarding labor, equipment, materials, crews, unit prices, quotes, sub-contractor markups and prime contractor markups. This philosophy was taken wherever practical within the time constraints. It was supplemented with estimating information from other sources where necessary such as from quotes, bid data, and Architect-Engineer (A-E) estimates. It is to be noted that after development of the Cost and Schedule Risk Analysis (CSRA), the Alternatives within the final array were further refined so some minor inconsistencies between the Cost Appendix and the Engineering Appendix may be present.

Cost estimates for the final array of structural alternatives (Alternatives 4a, 4a.1, 4b, 5, 6a, 6b, 6c, 7, 8, 9a, and 9b) were developed at a Class 4 level of effort utilizing largely parametric unit prices from sources such as historical Government and Commercial bid data, A-E cost estimates available from design reports, the 2019 Gordian/RS Means Cost Data Books and other available historical cost data sources. For developing costs for levee and floodwall construction items such as “Clearing and Grubbing”, “Embankment, Compacted Fill”, and “Reinforced Concrete Floodwall,” the standard approaches for developing a feasibility cost regarding cost elements such as labor, equipment, materials, crews, unit prices, subcontractor and prime contractor markups were used.

There are twelve (12) new unique pump station (PS) structures included in the Coastal Storm Risk Management (CSRM) alignments, which include Alternatives 4a, 4a.1, 5, 6a, 6b, 6c, 7, 9a, and 9b. The unique pump stations are Bayou Lacombe PS, Bayou Pacquet PS, Bayou Liberty PS, Bayou Bonfuca PS, Schneider Canal PS, W-14 PS, Gum Bayou PS, West Beach Avenue PS, Lafayette Street PS, Coffee Street PS, Girod Street PS, and Ravine Aux Coquilles PS, which are all located within St. Tammany Parish. The Hydraulics designer stated no additional pump stations will be required for any of the final array of alternatives, but new costs for these pump stations will be needed depending on the size (CFS). Updated and more accurate design is necessary and additional costs will be included where necessary. During feasibility level design of the TSP, all of the pump stations within the proposed alignments will be further developed and the associated costs individually defined. The West Shore Lake Pontchartrain (WSLP) 35% Conceptual Design Submittal, dated August 2020, was very useful to the feasibility study in developing costs for pump station features of work. The WSLP had already developed 35% conceptual designs for pump stations of similar size, scope and site layout of the pump station alternatives presented in the final array. The A-E cost estimates were developed from the WSLP, which included itemized quantities in sufficient enough detail as to be useful in prorating the quantities for twelve (12) representative pump stations. Unit costs for the representative structures were reviewed for reasonableness and then applied to the revised quantities to develop new total costs for the representative structures. The cost factor differential for each representative structure was then applied to other similar structures within each alignment.

Historical cost pricing data was very useful to the feasibility study in developing costs for the six (6) Sluice Gates, nine (9) marine sector gates, eleven (11) pedestrian roller gates and sixty-six (66)

vehicular roller gates within all final array alternatives. Unit costs for the representative gate structures were reviewed for reasonableness and then applied to the revised quantities to develop new total costs for the representative structures. The cost factor differential for each representative structure was then applied to other similar structures within each alignment. In the final step, cost of each structure was then escalated to 4th Quarter 2020 pricing to develop new costs for all structures.

Cost estimates for the final array of channel improvements and clearing and snagging features were developed at a Class 4 level of effort utilizing largely parametric unit prices from sources such as historical Government and Commercial bid data, A-E cost estimates available from design reports, the 2019 Gordian/RS Means Cost Data Books and other available historical cost data sources. Historical unit costs for the representative channel improvements were reviewed for reasonableness and then applied to the revised quantities to develop new total costs for the channel improvements. During feasibility level design of the TSP, the Channel Improvement features within the proposed alignments will be further developed and the associated costs individually defined.

The intent of the cost estimate was to provide or convey a “fair and reasonable” estimate and where cost detail was provided, it depicted the local market conditions. The construction work (e.g., levees, floodwalls, gate structures, control structures, dredging, excavation, dewatering, pilings, rock, etc.) is common to the Gulf Coast region. The construction sites are mostly accessible from land with additional water access available for the construction of the barge gate structure. Site access is easily provided from US Hwy 190, Interstate I-10, Interstate I-12, and other various local highways. Water access is available from the Mississippi River through the Inner Harbor Navigation Canal (IHNC), Lake Pontchartrain, Lake Borgne, and the Pearl River to reach waterways for the various waterway alternatives.

1.1.2 Estimate Structure

The estimates have been subdivided by alternative and each estimate contains U.S. Army Corps of Engineers (USACE) feature Work Breakdown Structure (WBS) codes. Each WBS cost is subdivided into base cost, contingency and total cost.

1.1.3 Bid Competition

It is assumed there will not be an economically-saturated market, and that bidding competition will be present.

1.1.4 Contract Acquisition Strategy

There is no declared contract acquisition plan/type at this time. It is assumed that the contract acquisition strategy will be similar to past projects with some negotiated contracts, with a focus and preference for small business/8(a) along with some large, unrestricted design-bid-build contracts.

1.1.5 Labor Shortages

It is assumed there will be a normal labor market pulled from the Gulf Coast region.

1.1.6 Labor Rates

Labor rates were developed comparing regional Gulf Coast labor market wages with the local Davis-Bacon Wage Determination, using whichever was determined greater. Regional Gulf Coast wage information was formulated from data gathered from approximately 20 different USACE, New Orleans District (CEMVN) construction projects in the Greater New Orleans region and is assumed to be a fair representation of wage rates for the St. Tammany area.

1.1.7 Materials

As parametric unit costs were used for the major construction items such as concrete, steel H-piling and sheet piling, silt fence, reinforcing steel, etc., no material quotes were obtained at this time. Material prices for steel piping used in relocation costs were taken from the 2019 Heavy Construction Costs RS Means Data Book. It is assumed that materials, except for borrow material, will be purchased as part of the construction contract and prices include delivery of materials.

Cost quotes are used on major construction items when available (such as the associated costs used for pump stations and vehicular and pedestrian roller and swing gates). Material price quotes were taken from previous jobs or from other historical data.

All borrow material is assumed to be government furnished. Specific sources for borrow material have not yet been established. There is considerable farmland and commercial borrow sites (e.g., Raceland Raw Sugars and River Birch) within a 15-mile radius of the project. Therefore, the PDT assumed an average one-way haul distance of 15 miles until a committed borrow source has been confirmed to be available. Haul speeds are estimated using a 35 mph average speed, given the rural access roads and highways that exist in the area.

Until a borrow source has been confirmed, the borrow quantity calculations will follow the CEMVN Geotechnical guidance as follows: for hauled levee material, 10 bank cubic yards (BCY) of borrow material = 12 loose cubic yards (LCY) hauled = 8 embankment cubic yards (ECY) compacted.

1.1.8 Quantities

Quantities for levees were provided by CEMVN Civil Branch – Levees Section. Quantities for floodwalls, pump stations, and access gates were provided by CEMVN Structures Branch. Quantities for channel improvements and clearing and snagging were provided by CEMVN Civil Branch – Waterways Section.

The PDT decided that for each alternative a comprehensive quantity of each levee feature would be provided. Alternatives 4a, 4a.1, 4.b, 5, 6a, 6b, 6c, and 7 contained levee features. The levee elevation varies depending on location. The preliminary assumptions are that the levee has a 10 ft wide levee crown and side slopes of 1V:3H. The existing elevations were obtained from the LIDAR raster dataset. Since the levee design elevation was variable, the designer calculated the area per station and multiplied it by the length. Quantities for levee construction were developed by the civil designer for the various alternatives and are provided in the Engineering Appendix. The Project Delivery Team (PDT) also decided at this time that the design elevation for all levees may need to be further

investigated to address levee settlement and global subsidence to comply with the latest HSDRRS design criteria.

Design parameters and quantities for the floodwalls, pump stations, vehicular and pedestrian roller gates, and marine sector gates were selected to be included in the final array of alternatives. Each alternative contains several of these features. Quantities for the pump stations and gates were scaled from historical data. The design parameters and quantities for each representative pump station or access gate were changed by the structural designer to meet the new design criteria for each alternative and new costs were developed for each representative structure for each alternative. The quantities and costs were scaled for each of these structures that was then applied to other similar structures in the alignment to generate new costs for those structures. During feasibility-level design of the TSP, all the structures within the proposed alignment will be further developed and the associated quantities individually defined.

Within Alternatives 5, 7, and 8, the various channel improvement and clearing and snagging feature quantities were developed using the LIDAR raster dataset. The preliminary design assumed a bank elevation depending on the location, required bottom width dependent on the channel requirements, and a typical bank at a 1V:3H slope. Staging areas were scoped and provided along with potential access points. The design parameters and quantities for each representative channel were provided by the civil designer to meet the required design depths for each feature and costs were developed for each representative channel for each feature within the alternative.

1.1.9 Equipment

Rates used for “Clearing and Grubbing” and “Embankment, Compacted Fill” cost items were based on the 2018 version of USACE EP-1110-1-8, Region III. Equipment was selected based on historical knowledge of similar projects.

Rates used are based on the latest USACE EP-1110-1-8, Region III. Adjustments are made for fuel and facility capital cost of money (FCCM). Full FCCM/Cost of Money rate is the latest available. The MII program takes the EP-recommended discount, but no other adjustments have been made to the FCCM. Equipment was chosen based on historical knowledge of similar projects.

1.1.10 Rental Rates

Judicious use of owned verses rented rates was considered based on typical contractor usage and local equipment availability. Where rental of equipment is typical, rental rates were applied (i.e. for marsh excavators in “Heavy Clearing and Grubbing” cost item; Tugboat, marine barges, etc., for barge gate structures and fronting protection where needed).

1.1.11 Fuels

Fuels (e.g., gasoline and diesel fuel) for rental equipment were based on local market averages for the Gulf Coast area. The fuel rates were reviewed over a period of time and a composite, conservative cost was used. Due to the volatility of fuel and significant potential escalation of fuel rate, conservative costs were used in the estimates.

1.1.12 Crews

Major crew and productivity rates were developed and studied by senior USACE estimators familiar with the type of work. The work is typical to the Gulf Coast area and is well understood by CEMVN cost engineers. The crews and productivity rates were checked by local CEMVN estimators and comparisons with historical cost data were referenced. Crews and productivity rates were adjusted as necessary based upon those findings to reflect reasonable crew sizes and production rates. Major crews are used for hauling, earthwork, piling, pump stations, floodwalls and concrete slope pavement.

A 10% markup on labor for weather delay was selectively applied to the labor in major earthwork-placing detail items, and associated items that would be affected by the weather, creating unsafe or difficult conditions to operate (e.g., trying to run dump trucks on a wet levee) or would be detrimental/non-compliant to the work being performed (such as trying to place/compact material in the rain). The 10% markup was to cover the common practice of paying for labor “showing up” to the job site and then being sent home due to minor weather conditions, which is part of known average weather impacts as reflected within the standard contract specifications.

Most crew work hours are assumed to be 10 hours, 6 days/week, which is typical for the project area.

1.1.13 Unit Prices

The unit prices found within the various project estimates fluctuate within a range between similar construction unit prices. Such pricing data was used for items such as pump stations, access gates, floodwall concrete, earthwork, concrete slope pavement, transitions, and piling. Variances are a result of differing haul distances (by truck or barge), small or large business markups, subcontracted items, designs and estimates by others. Unit prices were used in the development of the various cost estimates and are based upon historical data of recent jobs with a similar size and scope.

1.1.14 Relocation Costs

Relocation costs are defined as the relocation of public roads, bridges, railroads and utilities required for project purposes. In cases where potential significant impacts were known, relocation costs were included within the cost estimate. Information from the Relocations Designer showed no relocations of public roads, bridges or railroads were required for Alternatives 7, 8, 9a, and 9b, but Alternatives 4a, 4.1, 4b, 5, 6a, 6b, and 6c all contain some sort of relocations. The Relocations Designer did provide all utilities to be relocated for each of the alternatives (i.e. pipe - ownership, diameter, material, product, location) and these are shown in the Engineering Appendix. In addition, the Relocation Designer provided the proposed method of flood protection for underground pipe (i.e. whether the pipeline is sleeved through a T-wall or is relocated over the new earthen levee). Relocation of a pipeline to be relocated over the earthen levee includes excavation of a trench, including a Temporary Retaining Structure (TRS), if needed, hot tapping, demo/disposal of the existing pipeline, routing the new pipeline, and backfill and removal of the TRS. Relocation of a pipeline to be sleeved through a T-wall includes excavation, installation of the TRS, installation of the temporary support pipe, installation of the jack-in sheet pile, installation of the pipe sleeve, and backfill and removal of the TRS. The cost provided was based on historical bid data. In addition to “Pipeline Protection” and “Up-

and-Over" pipeline relocations, Alternatives 6a, 6b, and 6c all require de-energizing of powerlines, which is a matter of contacting the utility company and re-routing the overhead lines. Cost was developed using historical cost data and the 2019 Heavy Construction Gordian/RS Means Data Book. Additionally, an Owner Preconstruction Engineering Design (PED) of 22% and Supervision and Administration (S&A) of 5% was added to the cost of each relocation. Relocation costs were placed in Work Breakdown Structure WBS-02 Relocations.

1.1.15 Mobilization

Contractor mobilization and demobilization are based on the assumption that most of the contractors will be coming from within the Gulf Coast or Southern Region. Mobilization and Demobilization costs are based upon historical studies and detailed Government estimates with relevant historical cost pricing data, which are typically in the range of 3-5% of the construction costs. With undefined acquisition strategies and assumed individual project limits, the estimates utilize a 5% value of Cost to Prime for Mobilization and Demobilization for all alternatives.

1.1.16 Field Office Overhead

The estimated percentages for Field Office Overhead vary based upon the type of work being completed, as "Clearing and Snagging" field overhead differs from "Floodwall" field overhead. The rates were based upon estimating and negotiation experience, and consultation with local construction representatives. The estimates used a field office overhead rate based on the average of relevant jobs with a similar scope and magnitude. Different percentages are used when considering the scope of work for each feature. However, when reviewing historical cost pricing data, a range of 15 -25% is typically used. The field office overhead rate of 18% was used for the prime contractors, which was based on historical projects.

1.1.17 Overhead Assumptions

Overhead assumptions may include costs for the superintendent, the office manager, pickup trucks, periodic travel costs, communications, temporary offices (contractor and Government), office furniture, office supplies, computers and software, as-built drawings and minor designs, tool trailers, staging setup, camp/facility/kitchen maintenance and utilities, utility service, toilets, safety equipment, security and fencing, small hand and power tools, project signs, traffic control, surveys, temporary fuel tank station, generators, compressors, lighting and minor miscellaneous items.

1.1.18 Home Office Overhead

The estimated percentages vary based upon consideration of 8(a), small business and unrestricted prime contractors. The rates were based upon estimating and negotiating experience, and consultation with local construction representatives. Different percentages are used when considering the contract acquisition strategy regarding small business 8(a), competitive small business and large business, high to low, respectively. For Home Office Overhead a percentage of 9% was assumed.

1.1.19 Taxes

Local taxes on supplies and materials needed for construction would be applied based on the parishes that contain the work. Reference the tax rate website for Louisiana: http://www.salestaxstates.com. The contracts are located in many different areas within St. Tammany Parish. Usually the tax rate ranges from 8 to 10%. For this project it was decided to use 9.75%.

1.1.20 Bond

The Bond interest rate was assumed to be 1%, applied against the prime contractor, assuming large contracts. There was no differentiation between large and small businesses.

1.1.21 Real Estate Costs

Real Estate (RE) costs were developed and provided by the Realty Specialist and placed in WBS-02 Lands and Damages. The RE cost for each alternative includes land costs, acquisition costs (including acquisition of agricultural land for borrow) and 25% for contingencies.

1.1.22 Environmental Costs

Environmental costs were provided by the Environmental team and placed in Work Breakdown Structure WBS-06 Fish and Wildlife Facilities. The Environmental costs for each alternative includes only mitigation of the flood protection alignment footprint.

1.1.23 Cultural Resources Costs

Cultural Resources (CR) costs were provided by the Archaeologist-Natural/Cultural Resources Analyst and placed in WBS-13 Cultural Resources Preservation. The CR costs for each alternative include Phase I & II Cultural Surveys and mitigation of resources if required. For borrow sites, known or identified cultural resource sites will be avoided.

1.1.24 Pre-Construction Engineering and Design (PED)

The PED cost included such costs as USACE project management, engineering, planning, designs, investigations, studies, reviews, value engineering (VE) and engineering during construction. Historically, a rate of approximately 12% for Engineering and Design (E&D) portion, plus small percentages for other support functions, is applied against the estimated construction costs. Other USACE civil works districts such as St. Paul, Memphis and St. Louis have reported values ranging from 10% to 15% for E&D. Additional support functions might include project management, engineering, planning, designs, investigations, studies, reviews and VE. A PED rate of 20.5% was applied for this project.

1.1.25 Supervision and Administration (S&A)

Historically, a range from 5% to 15%, depending on project size and type, has been applied against the estimated construction costs. Other USACE civil works districts such as St. Paul, Memphis and St. Louis report values ranging from 7.5% to 10%. Consideration is given that a portion of the

Supervision and Administration (S&A) effort could be performed by contractors. An S&A rate of 11% was applied for this project.

1.1.26 Contingencies

Contingencies for the final array of structural alternatives were developed using the USACE Abbreviated Cost Risk Analysis (ARA) program. An ARA is a qualitative approach used by the PDT to address key risk concerns for major features of work and their impact to cost and schedule drivers such as Project Scope Growth, Acquisition Strategy, Construction Elements, Quantities, Specialty Fabrication or Equipment, Cost Estimate Assumptions and External Project Risks. A separate ARA was conducted for all Alternatives, with each analysis resulting in a composite risk contingency of ranging between 41 to 56%. As Alternative 6c was added very late as a final alternative, it was decided by the PDT that the same 45% composite risk contingency from Alternatives 6a and 6b could logically be applied to Alternative 6c, since each of the structural alternatives in Alternative 6 had the same features of work and very similar risk concerns. It should be noted Real Estate, PED and S&A costs were not included in formulating the composite risk contingency.

1.1.27 Escalation

The escalation for the structural items taken from the historical cost pricing data were based upon the latest version of the USACE Engineering Manual (EM) 1110-2-1304, “Civil Works Construction Cost Index System (CWCCIS)”.

1.1.28 Hazardous, Toxic and Radioactive Waste (HTRW)

Phase 1 surveys have not been performed, but preliminary investigation by the Biologist indicates no issues were found along the proposed final alternative alignments and the risk of finding HTRW in the mostly rural and residential areas that are along the alignment is low. At this time there is no reason to believe HTRW will be found, therefore, the estimates do not include costs for any potential HTRW.

1.1.29 Schedule

The project schedule for each structural alternative was developed based on the construction features of work. A generic construction schedule was applied to all of the alternatives for comparison purposes.

Plan Formulation/Project Management for the St. Tammany Parish study have directed that construction of the system be assumed to begin in 2027 with a complete risk reduction system in place by 2032. The expected construction period for each alternative is five (5) years each. For the purposes of this study, construction was assumed to begin in 2027 and continue through 2032 with additional levee lifts (to maintain levee height due to sinking and subsidence) occurring at three times post-initial construction: 5-7 years, 15-20 years, and 30 years. For the levees, the first levee lifts would be overbuilt and allowed to settle for several years before the successive levee lift is added for each alternative.

1.1.30 Cost Estimates

The final array of alternatives, from which a TSP was selected, consisted of Alternatives 4a, 4a.1, 4b, 5, 6a, 6b, 6c, 7, 8, 9a, and 9b and the future without project conditions. Tables 1-1 through 1-11 show the baseline project cost for each structural alternative in the final array. All costs are at October 2020 price levels.

***Table 1-1: Alternative 4a – Lacombe Levee**

Feature	Cost	Contingency	Total
01 Lands and Damages	$7,059,000	$1,190,000	$8,249,000
02 Relocations	$20,203,000	$5,657,000	$25,860,000
06 Fish and Wildlife Facilities	$45,324,000	$25,835,000	$71,159,000
11 Levees and Floodwalls	$18,341,000	$7,887,000	$26,228,000
13 Pumping Plant	$178,073,000	$78,352,000	$256,426,000
18 Cultural Resources Preservation	$155,000	$56,000	$210,000
30 Planning, Engineering & Design	$44,438,000	$19,971,000	$64,409,000
31 Construction Management	$23,845,000	$10,716,000	$34,561,000
TOTAL	$337,439,000	$149,663,000	**$487,101,000**

***Table 1-2: Alternative 4a.1 – Shorter Lacombe Levee**

Feature	Cost	Contingency	Total
01 Lands and Damages	$5,707,000	$1,032,000	$6,739,000
02 Relocations	$14,299,000	$4,004,000	$18,302,000
06 Fish and Wildlife Facilities	$37,724,000	$21,503,000	$59,227,000
11 Levees and Floodwalls	$17,570,000	$7,555,000	$25,125,000
13 Pumping Plant	$178,073,000	$78,352,000	$256,426,000
18 Cultural Resources Preservation	$130,000	$47,000	$177,000
30 Planning, Engineering & Design	$43,065,000	$19,371,000	$62,436,000
31 Construction Management	$23,108,000	$10,394,000	$33,502,000
TOTAL	$319,676,000	$142,258,000	**$461,934,000**

***Table 1-3: Alternative 4b – Lacombe/West Slidell Levee**

Feature	Cost	Contingency	Total
01 Lands and Damages	$4,739,000	$810,000	$5,549,000
02 Relocations	$10,408,000	$2,914,000	$13,323,000
06 Fish and Wildlife Facilities	$84,947,000	$48,420,000	$133,368,000
11 Levees and Floodwalls – Levees	$31,834,000	$15,121,000	$46,955,000
11 Levees and Floodwalls – Floodwalls	$6,155,000	$2,339,000	$8,493,000
13 Pumping Plant	$609,391,000	$237,662,000	$847,053,000
18 Cultural Resources Preservation	$232,000	$84,000	$316,000
30 Planning, Engineering & Design	$134,894,000	$55,656,000	$190,550,000
31 Construction Management	$72,382,000	$29,864,000	$102,246,000
TOTAL	$954,983,000	$392,870,000	**$1,347,853,000**

***Table 1-4: Alternative 5 – Lacombe/West Slidell Levee**

Feature	Cost	Contingency	Total
01 Lands and Damages	$5,723,000	$1,459,000	$7,182,000
02 Relocations	$729,000	$204,000	$933,000
06 Fish and Wildlife Facilities	$102,483,000	$58,416,000	$160,899,000
09 Channels and Canals	$3,241,000	$5,250,000	$8,491,000
11 Levees and Floodwalls – Levees	$16,531,000	$7,852,000	$24,383,000
11 Levees and Floodwalls – Floodwalls	$4,786,000	$1,867,000	$6,653,000
13 Pumping Plant	$431,317,000	$170,370,000	$601,688,000
15 Floodway Control and Diversion Structures	$45,315,000	$16,314,000	$61,629,000
18 Cultural Resources Preservation	$528,000	$190,000	$718,000
30 Planning, Engineering & Design	$103,002,000	$44,317,000	$147,318,000
31 Construction Management	$55,269,000	$23,780,000	$79,049,000
TOTAL	$768,925,000	$330,018,000	**$1,098,943,000**

***Table 1-5: Alternative 6a – South Slidell without Eden Isle**

Feature	Cost	Contingency	Total
01 Lands and Damages	$5,416,000	$1,089,000	$6,505,000
02 Relocations	$13,000	$3,000	$16,000
06 Fish and Wildlife Facilities	$43,133,000	$24,586,000	$67,719,000
11 Levees and Floodwalls – Levees	$32,359,000	$15,370,000	$47,729,000
11 Levees and Floodwalls – Floodwalls	$263,957,000	$95,025,000	$358,982,000
13 Pumping Plant	$227,264,000	$99,996,000	$327,261,000
18 Cultural Resources Preservation	$352,000	$127,000	$478,000
30 Planning, Engineering & Design	$107,409,000	$44,531,000	$151,940,000
31 Construction Management	$57,634,000	$23,895,000	$81,529,000
TOTAL	$737,537,000	$304,621,000	**$1,042,158,000**

***Table 1-6: Alternative 6b – South Slidell with Eden Isle**

Feature	Cost	Contingency	Total
01 Lands and Damages	$5,022,000	$1,135,000	$6,157,000
02 Relocations	$13,000	$3,000	$16,000
06 Fish and Wildlife Facilities	$62,919,000	$35,864,000	$98,783,000
11 Levees and Floodwalls – Levees	$27,452,000	$13,040,000	$40,491,000
11 Levees and Floodwalls – Floodwalls	$588,181,000	$240,566,000	$828,746,000
13 Pumping Plant	$227,264,000	$99,996,000	$327,261,000
18 Cultural Resources Preservation	$489,000	$176,000	$666,000
30 Planning, Engineering & Design	$172,897,000	$74,332,000	$247,229,000
31 Construction Management	$92,774,000	$39,885,000	$132,659,000
TOTAL	$1,177,011,000	$504,997,000	**$1,682,008,000**

***Table 1-7: Alternative 6c – West Slidell and South Slidell Levee Combination**

Feature	Cost	Contingency	Total
01 Lands and Damages	$11,139,000	$2,660,000	$13,799,000
02 Relocations	$739,000	$148,000	$887,000
06 Fish and Wildlife Facilities	$75,197,000	$42,862,000	$118,059,000
11 Levees and Floodwalls – Levees	$49,864,000	$23,835,000	$73,699,000
11 Levees and Floodwalls – Floodwalls	$131,888,000	$59,613,000	$191,501,000
13 Pumping Plant	$658,582,000	$289,776,000	$948,358,000
18 Cultural Resources Preservation	$730,000	$263,000	$993,000
30 Planning, Engineering & Design	$172,570,000	$78,380,000	$250,950,000
31 Construction Management	$92,598,000	$42,058,000	$134,656,000
TOTAL	$1,193,306,000	$539,595,000	**$1,732,901,000**

***Table 1-8: Alternative 7 – Eastern Slidell**

Feature	Cost	Contingency	Total
01 Lands and Damages	$4,417,000	$836,000	$5,253,000
02 Relocations	---	---	---
06 Fish and Wildlife Facilities	$47,561,000	$27,110,000	$74,671,000
09 Channels and Canals	$11,696,000	$585,000	$12,281,000
11 Levees and Floodwalls – Levees	$10,831,000	$5,145,000	$15,975,000
11 Levees and Floodwalls – Floodwalls	$25,839,000	$14,470,000	$40,309,000
13 Pumping Plant	$56,817,000	$19,318,000	$76,135,000
18 Cultural Resources Preservation	$371,000	$134,000	$505,000
30 Planning, Engineering & Design	$21,639,000	$9,435,000	$31,073,000
31 Construction Management	$11,611,000	$5,063,000	$16,673,000
TOTAL	$190,782,000	$82,094,000	**$272,876,000**

***Table 1-9: Alternative 8 – Upper Tchefuncte**

Feature	Cost	Contingency	Total
01 Lands and Damages	$5,656,000	$1,367,000	$7,023,000
02 Relocations	---	---	---
06 Fish and Wildlife Facilities	$3,266,000	$1,861,000	$5,127,000
08 Roads, Railroads, & Bridges – Culverts	$7,929,000	$4,361,000	$12,291,000
09 Channels and Canals	$11,424,000	$6,283,000	$17,708,000
18 Cultural Resources Preservation	$113,000	$41,000	$153,000
30 Planning, Engineering & Design	$3,991,000	$2,203,000	$6,193,000
31 Construction Management	$2,141,000	$1,182,000	$3,323,000
TOTAL	$34,520,000	$17,298,000	**$51,818,000**

***Table 1-10: Alternative 9a – Mandeville Lakefront – 7.3 ft with Passive Barrier**

Feature	Cost	Contingency	Total
01 Lands and Damages	$9,955,000	$2,536,000	$12,491,000
02 Relocations	---	---	---
06 Fish and Wildlife Facilities	$5,416,000	$3,087,000	$8,503,000
11 Levee and Floodwalls – Seawall	$21,115,000	$10,557,000	$31,672,000
11 Levee and Floodwalls – Floodwall	$45,713,000	$19,657,000	$65,370,000
11 Levee and Floodwalls – I – Wall	$5,263,000	$2,263,000	$7,526,000
13 Pumping Plant	$7,833,000	$2,193,000	$10,027,000
18 Cultural Resources Preservation	$135,000	$48,000	$183,000
30 Planning, Engineering & Design	$16,412,000	$7,259,000	$23,671,000
31 Construction Management	$8,806,000	$3,895,000	$12,702,000
TOTAL	$120,648,000	$51,496,000	**$172,144,000**

***Table 1-11: Alternative 9b – Mandeville Lakefront – 7.3 ft with Tributary Closure**

Feature	Cost	Contingency	Total
01 Lands and Damages	$9,955,000	$2,536,000	$12,491,000
02 Relocations	---	---	---
06 Fish and Wildlife Facilities	$5,323,000	$3,034,000	$8,357,000
11 Levee and Floodwalls – Seawall	$21,115,000	$10,557,000	$31,672,000
11 Levee and Floodwalls – Floodwall	$10,670,000	$4,588,000	$15,259,000
11 Levee and Floodwalls – I – Wall	$3,376,000	$1,452,000	$4,828,000
13 Pumping Plant	$54,309,000	$19,551,000	$73,860,000
18 Cultural Resources Preservation	$61,000	$22,000	$83,000
30 Planning, Engineering & Design	$18,354,000	$7,586,000	$25,940,000
31 Construction Management	$9,848,000	$4,070,000	$13,919,000
TOTAL	$133,011,000	$53,397,000	**$186,409,000**

The total baseline project cost for the comprehensive nonstructural alternative for floodproofing both the CSRM and FRM 50-year floodplain is $4,501,184,454.

1.1.31 NED Plan/Tentatively Selected Plan

The final array of alternatives was compared based on a variety of factors such as input from economics, hydraulic impacts and non-Federal sponsor coordination. Within each alternative, each respective feature was analyzed independently for net benefits and a Coastal Storm Risk Management (CSRM), Flood Risk Management (FRM), and Nonstructural plan was selected to form one comprehensive Tentatively Selected Plan (TSP).

For the analysis of the CSRM features, the West Slidell Levee (feature in Alternative 4), South Slidell Levee (feature in Alternative 5), a combined South Slidell and West Slidell Levee (feature in Alternative 6a), and the South Slidell Levee with Eden Isle Floodwall (feature in Alternative 6b) were found to have net positive benefits within the CSRM analysis, which had net benefits of 1.2, 1.9, 1.7, and 1.5 respectively. CSRM measures that were not economically beneficial were the Lacombe Levee (feature in Alternative 4a), the Shorter Lacombe Levee (feature in Alternative 4a.1), the Combined Lacombe and West Slidell Levee (feature in Alternative 5), and the Mandeville Floodwall (features in Alternative 9a and 9b). Those respective features were not economically justifiable with BCR's of 0.4, 0.5, 0.9, 0.2, and 0.4 respectively. Based on the economic analysis of the final array of each feature within the alternatives for the Coastal Storm Risk Management Plan, the West Slidell and South Slidell Levees were combined and selected as the PDTs CSRM feature within the TSP with a net benefit to cost ratio 1.8.

For the analysis of the FRM features, the Bayou Patassat Clearing and Snagging (feature in Alternative 5) and Mile Branch Channel Improvements (feature in Alternative 8) were found to have positive net benefits, 2.9 and 2.2 respectively. All of the other Flood Risk Management features such as the Bayou Liberty Channel Improvements, Bayou Bonfuca Detention Pond, Pearl River Levee, Gum Bayou Diversion, Poor Boy Canal Channel Improvements, Doubloon Bayou Channel Improvement, and Mile Branch Lateral A Channel Improvement were not economically beneficial with standalone BCR's of 0.4, 0.2, 0.4, 0.0, 0.0, -1.2, and 0.3 respectively. Based on the economic analysis of the final array of each feature within the alternatives for the Flood Risk Management (FRM) Plan, Bayou Patassat Clearing and Snagging and Mile Branch Channel Improvements were selected as the PDTs FRM feature within the TSP with a net benefit to cost ratio of 2.9 and 2.2 respectively.

To complete the selection for the comprehensive TSP, nonstructural features for both the FRM and CSRM were also analyzed independently for benefit to cost ratio. Nonstructural home elevations and floodproofing for the rest of the Parish based on the 50-year flood plain (residual risk) were found to have a net benefit to cost ratio of 1.9 and were included in the PDTs TSP.

The comprehensive TSP selected by the PDT to address flooding Parish-wide includes CSRM, FRM and Nonstructural features. Those features included are the West Slidell and South Slidell Levees, Bayou Patassat Clearing and Snagging, Mile Branch Channel Improvements, and nonstructural home elevations and floodproofing for the rest of the Parish based upon the 50-year flood plain risk. This comprehensive plan was evaluated and found to have a positive net benefit to cost ratio of 1.8.

As part of system optimization during Feasibility Level design, in conjunction with new hydraulic information from "Future with Project Conditions" and associated overtopping conditions, non-structural measures could be re-introduced in certain targeted populated areas.